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Hard Tissue Ablation Simulations Using the LATIS Computer Code

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Bio: D. S. Bailey is a physicist in the X-Division code development group with particular interests in computational fluid dynamics, laser propagation and atomic physics as applied to material properties.

Abstract

We present detailed simulation of hard tissue removal with short pulse lasers using the LATIS computer code. These simulations include laser propagation and absorption and the resulting thermal and hydrodynamic material responses. The results include material removal efficiency and thermal damage effects.

Hard Tissue Ablation Simulations Using LATIS

We have made numerical simulations for short pulse laser ablation of hard tissues (teeth, bone). The simulations use a wave solver for the laser propagation together with a Keldish model for multiphoton breakdown and comcomitant absorption to yield the net laser deposition in space and time. Using the energy deposition, we can simulate the thermal and hydrodynamic effects, including material strength with rate and density dependent strength coefficients. From the simulations we can derive the amount of material removed by each laser pulse, and thereby design a treatment regime to maximize the desired ablation effects and minimize the collateral damage.

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